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(54) **METHODS OF AND APPARATUS FOR MOORING AND FOR CONNECTING LINES TO ARTICLES ON THE SEABED**

VERFAHREN UND VORRICHTUNGEN ZUM FESTMACHEN UND VERBINDEN VON LEINEN AN GEGENSTÄNDEN AUF DEM MEERESBODEN

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Description

[0001] This invention relates to methods of and apparatus for connecting lines to articles on the seabed. The primary purpose is to provide a mooring apparatus and a method of mooring suitable for use with large offshore production vessels, such as drilling vessels and production buoys. However, the invention can be applied anywhere where it is desired to attach a heavy tether to an article already deployed on the seabed, for anchoring another article, or for lifting the seabed article itself. The term "tether" will be used to refer to a mooring leg, but also includes a hoisting cable or chain, unless the context requires otherwise.

[0002] Offshore production vessels need to be held within a strict geographical area at all times no matter the weather and tidal flow to ensure safe and continuous production and flow of hydrocarbons or gases. A typical mooring system for a production vessel comprises a loading buoy (otherwise known as a catenary anchor leg mooring (CALM) buoy) having a number of anchors deployed about it to hold the buoy in position via connecting lines. A typical arrangement for the deployment of these anchors is in a circle centred on the buoy. This type of arrangement means that the loads and forces that will be exerted on the buoy by the sea and climatic conditions can be resisted no matter the direction from which they originate. Normally any moored vessel will be able to rotate (or "weathervane") in relation to the buoy. In alternative installations, the vessel may be directly anchored to the seabed without use of a loading buoy. The present invention may be used to set an array of anchors in the seabed about the buoy/vessel. The anchors may comprise simple weights, suction anchors or drag-embedment anchors.

[0003] In conventional arrangements the buoy or production vessel is held in place by a series of anchors buried in the seabed. This normally means between 6 and 12 anchors equidistantly spaced (or spaced in groups) about the circumference of a circle formed with the buoy at its centre so that the buoy is held in place. Each anchor is at the end of a mooring leg extending from the vessel or buoy to the seabed. The terms "mooring leg" and "main tether" are used to encompass a variety of specific forms of tether, of which heavy chain is the most typical example. Other forms of mooring leg are of course possible, and often comprise sections of chain and sections of cable, connected together according to the properties required at each point along their extent.

[0004] Needless to say, the greater the depth of water in which the buoy is deployed the longer the chain and the greater the weight that has to be deployed. In order to deploy and embed the anchor conventional methods involve locating and deploying the anchor with it connected to a mooring leg of the buoy. The anchor is therefore deployed with the full weight of the chain, which forms a part of the mooring leg and connects the anchor to the loading buoy. The sheer weight even with the apparent

lightening effect of the water becomes burdensome and difficult to operate with. In addition, the buoy or vessel to be moored has to be on site when the operation is being carried out, which could be a number of days. Logistically this is inefficient as the buoy/vessel is in effect out of service and the operation is more difficult to timetable.

[0005] Methods are known to deploy the anchor, either by itself or with a portion of the mooring leg chain or wire attached, before connection to the main mooring leg. One such method is disclosed in WO 02/062653. In this case connection is made by use of a Remotely Operated Vehicle (ROV) manipulator and vessel crane only, which is difficult to control properly and therefore slow to do, requiring particularly skilled ROV piloting. Other systems make use of purpose made mooring line connectors, such as disclosed US6158093, and as such increase the cost and complexity of the mooring line system.

[0006] Document EP 1 283 158 is considered as closest prior art and reveals all features of the preamble of independent claim 1.

[0007] It would be desirable, therefore, to be able to pull-in and connect subsea mooring line connections remotely without assistance from divers or purpose made mooring line connectors.

[0008] In a first aspect of the invention there is provided tether connection apparatus for remotely interconnecting respective free ends of first and second portions of a mooring tether, said apparatus comprising:

pull-in means operable to pull-in to said apparatus the free end of one of said portions of mooring tether, subsequent to deployment of the apparatus;
means for releasably mounting a connector, said means being designed to mount a connector that is operable to interconnect the respective free ends of said first and second portions of the mooring tether, once said pull-in means has pulled in to said apparatus the free end of a first of said portions of mooring tether, said means being operable to release the connector subsequent to interconnection.

[0009] Said tether connection apparatus may be operable to have said connector mounted to said means for releasably mounting a connector, wherein said connector is attached to the free end of a second of said portions of mooring tether, prior to deployment of the apparatus. Said tether connection apparatus may be operable such that said first of said portions of mooring tether is attached to an anchor on the seabed, while the second of said portions of mooring tether is attached to an object to be moored.

[0010] Said means for releasably mounting a connector may be designed specifically to enable mounting of standard connectors, already commonly used for connecting lines, or portions of lines together. Such connectors may be any of the type commonly used to connect together, for example, chain with chain, chain with wire or wire with wire, as appropriate. Such connectors may

include, a shackle with associated pin, spelter sockets, chain links or triplates. This means that expensive and complicated purpose made mooring line connectors can be dispensed with. Said means for releasably mounting a connector may be adapted to be able to mount two or more types of connectors.

[0011] Said apparatus may further comprise a suitable connector, pre-installed on said means for releasably mounting a connector.

[0012] Said apparatus may further comprise alignment means for aligning one portion of the mooring tether with the other prior to their being interconnected. Said alignment means may comprise a channel. Said channel may be arranged to accommodate the free end of said portions of mooring tether to correctly locate and align said free end, for subsequent interconnection. Said channel may have a relatively wide opening, tapering inwards, thus forming a funnel shape. Said channel may include a restricted section for locating and orienting one of said free ends of portion of mooring tether. Said restricted section may include one or more locating pins. Said one or more locating pins may be designed to cooperate with and therefore properly locate and orientate a link of mooring chain. Said one or more locating pins may be adaptable, either by themselves or by way of the addition of an adaptor, so to be able to properly position wire, as well as chain. Said channel may be located on carriage allowing movement of said channel, and therefore said portion of said mooring leg located therein, relative to said first portion of the mooring tether and/or said connecting means. Said carriage may allow movement along the axis of the connection. The carriage may also allow for lateral movement.

[0013] Said pull-in means may comprise a winch.

[0014] In a further aspect of the invention there is provided a method of mooring an object to the seabed using the tether connection apparatus of the first aspect of the invention, said method comprising:

installing a connector on said tether connection apparatus;

installing at least one anchor on the seabed, said anchor having a first portion of mooring tether attached thereto.

installing said tether connection apparatus to the free end of a second portion of mooring tether, the other end of which being attached to the object to be moored;

connecting the free end of a second portion of mooring tether to said connector;

deploying said free end of the second portion of mooring tether with said tether connection apparatus attached thereto;

using said pull-in means to pull in the free end of said first portion of mooring tether to said tether connection apparatus;

connecting the free end of said first portion of mooring tether to said connector, thus interconnecting the

first and second portions of mooring tether; and releasing the connector from said means for releasably mounting a connector.

[0015] Although some of the above steps rely on other steps being completed, it should be apparent to the skilled person that not all the steps necessarily need be done in the above order, and that some steps may be done simultaneously with others.

[0016] The step of installing said connector on said tether connection apparatus may be done as an initial step such that the connector is pre-installed on said tether connection apparatus. In this case said connecting of the free end of a second portion of mooring tether to said connector may be done prior to the deployment step, for example when installing said tether connection apparatus to the free end of a second portion of mooring tether. Some or all of these steps may be done on an installation vessel. Equally, the free end of a second portion of mooring tether may be connected to said tether connection apparatus before installation of the connector.

[0017] Alternatively the step of installing said connector on said tether connection apparatus may be done after deployment of the tether connection apparatus. In this case the connecting of the free end of a second portion of mooring tether to said connector will also be done after deployment, once said connector has been installed on said tether connection apparatus.

[0018] Said first and second portions of mooring tether may consist of chain or wire. In one embodiment said first portion consists of chain and said second portion consists of wire.

[0019] One or more of the steps including and subsequent to the deployment step may be done by a Remotely Operated Vehicle (ROV).

[0020] Said method preferably comprises the final step of recovering said tether connection apparatus. This may be done by an ROV.

[0021] Said method may further comprise the step of aligning one portion of the mooring tether with the other prior to their being interconnected. In one embodiment it is the free end of first portion of the mooring tether that is aligned relative to the free end of said second portion of the mooring tether and connector. Said free end of first portion of the mooring tether may be pulled into a channel comprised in said tether connection apparatus to correctly locate and align said free end, for subsequent interconnection. Said channel, and therefore said portion of said mooring leg located therein, may be moved relative to second portion of the mooring tether and said connecting means to aid alignment.

[0022] Said connector may comprise a shackle with associated pin, spelter sockets, chain links or triplates.

[0023] Said first portion of mooring tether may be pre-routed on the seabed prior to it being pulled-in to said tether connection apparatus.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] Embodiments of the invention will now be described, by way of example only, by reference to the accompanying drawings, in which:

Figure 1 shows (a) a plan of a production vessel mooring arrangement, and (b) a side view of part of the arrangement;

Figure 2 shows a pull-in and connection device in accordance with an embodiment of the invention, and

Figure 3a to 3k depict a method of installing a mooring leg using the device according to an embodiment of the invention.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0025]

Figure 1 of the accompanying drawings shows a typical schematic representation of an installation of a floating production vessel P moored in place via buoy B such that it can "weathervane" around the buoy B. The buoy B is held in place using 8 (eight) anchors 1 fixed to the buoy B by chains C of respective mooring legs and buried in the seabed so that they are equally spaced around the circumference of a circle centred on the vessel P.

Figure 2 shows a device 100 suitable for undertaking chain and wire pull-in and connection of mooring legs subsea. The mooring legs in this example are Chain-Wire, but could be Chain-Chain, Wire-Wire, or Wire-Chain. The device 100 comprises a frame 110, an alignment system 120, a connector 140 and shackle/socket pin 160, preinstalled on said frame 110, and a pull in winch 180. Also shown are the first chain section 200a of the mooring leg 200 and the second wire section 200b of the mooring leg 200.

[0026] Considering the alignment system 120 of this embodiment in more detail, this comprises a carriage 220 movable along the frame 110 on tracks 240. On the carriage is a funnel 260 leading to a narrow channel 270 with locating pins 280 therein.

[0027] In use, the device 100 is pre-installed onto one end of one of the portions 200b of the mooring leg 200 to be connected. The device 100 has remote operated functions, controlled by, and powered from, a Remotely Operated Vehicle (ROV), for pull-in, alignment and locking of the other portion of the mooring leg, installation and securing of shackle/socket pin and release of connection from device 100. Pull-in and connection operations can be performed on seabed or midwater.

[0028] Figures 3a to 3k depict a method of installing a

mooring leg 200 using the device 100 described above. To begin, the loading buoy that is to be moored is suspended by a crane, temporarily suspended midwater and held in place by a deadman anchor on the seabed or held in position on the surface. The mooring anchor 1 is also installed on the seabed with its portion of the mooring leg 200a (in this case a chain, although it may be wire, rope or of other suitable construction) attached, this chain being pre-routed on the seabed such that its free end is in the vicinity of the buoy;

- Figure 3a shows one end of the other portion of the mooring leg 200b, which had been previously abandoned on the seabed, being picked up by a Remotely Operated Vehicle (ROV) 310 and attached to the crane wire 315 of the installation vessel. (The other end of this portion of the mooring leg 200b is attached to the loading buoy).

- In Figure 3b, this end of the portion of the mooring leg 200b (which in this case is a wire, but may again be of other suitable construction) is lifted to the work platform 315 of the installation vessel, where it is attached by line 320 to a tugger 325. In place on the installation vessel is device 100. At this point buoyancy is removed from the portion of mooring leg 200b.

- The end of the mooring leg 200b is lifted further by the crane wire 315, and with the catenary weight taken by holdback slings 330 and with the help of the tugger 325, the end of the mooring leg 200b is lowered toward the device 100.

- Figure 3c shows the end of the mooring leg 200b having been lowered into place on device 100. The socket 335 at the end of the mooring leg 200b is then placed in the clevis of the device 100 and the socket 335 body is strapped down to the device 100..

- Figure 3d shows the device 100 effectively installed to the end of the mooring leg wire portion 200b. On the work platform 315 of the installation vessel, a shackle and pin 160 with locking plate is installed to the socket 335 at the end of the mooring leg 200b, and an ROV releasable locking beam is used to secure the fixing to the device 100.

- Figure 3e shows the tugger line 320 being disconnected, this being done after disconnection of the holdback slings and attachment of the device 100 to the crane wire 315. The wire portion 200b of the mooring leg 200, with the device 100 attached can now be deployed ;

- Figure 3f shows the device having been lowered to about 1metre above the seabed, and within about 20 metres of the end of the chain portion 200a to which it is to be connected. The pull-in wire/tether 340 from the winch 180 on the device 100 is attached to the free end of the chain mooring leg 200a (pre-routed on seabed, the other end being attached to the anchor);

- Figure 3g shows the ROV 310 using its torque tool

to operate the winch 180 so that the pre-routed chain mooring leg 200a is pulled in to the device 100, until the chain hits stops on the device 100; In doing so it pulls the chain 200a into a funnel or channel 260. This funnel or channel 260 aligns the chain connector, in this case the final chain link 130, laterally with the wire connector 140. while the pins 280 locate in another chain link 250, thus holding that link 250, and as a result the connector 130, vertical.

- The ROV then uses its torque tool to lock and align the chain 200a in the device 100. The winch wire 340 is then removed, while a stop is placed between chain links 1 and 3 to hold the chain in place.
- Figure 3h shows the ROV using its torque tool to move the alignment carriage 220 toward the shackle 160. Precise longitudinal alignment can be made moving the carriage along the frame until the end of the chain 100a is aligned properly with the shackle 160. This carriage may also be movable laterally to aid alignment.
- Once aligned, each of the connectors are locked relative to each other to prevent misalignment during engagement of shackle/socket pin 160;
- Figure 3i shows the ROV using a pin insertion tool 370 to engage and secure the socket pin 160b into the shackle 160a and chain link 130. A C-plate can then secure the socket pin, making a permanent connection. Once made the surface winch line 350 can be attached to the connection, and the locking bar and straps attaching the connection to the device 100 can be released.
- Figure 3j shows the connection being lifted by the winch clear of the device 100. Device 100 is then recovered to the installation vessel.
- Figure 3k shows the ROV releasing the shackle connected to the socket, the connection now being complete.

[0029] The above steps can then be repeated for the next mooring leg connection.

[0030] The above embodiments are provided for illustration only, and other embodiments and variations are envisaged without departing from the spirit and scope of the invention. For example, the connector (a shackle and socket pin in the above example, although use of any suitable connector is envisaged) does not need to be pre-installed, and instead could be installed after deployment using an ROV. Furthermore, the above example is shown in relation to mooring a loading buoy, but other applications for this apparatus and method include, but are not limited to, the connections for the mooring lines of FPSOs (Floating, Production, Storage and Offloading vessels), rigs and riser systems.

[0031] The alignment system shown, in particular, is subject to many variations and embodiments. For example, the pins 280 of the alignment system may be adapted should it be a wire portion of a mooring leg that requires pulling in and aligning. Said pins 280 may be adaptable,

either by themselves or by way of the addition of an adaptor, so to be able to properly position both chain and wire.

5 Claims

1. A tether connection apparatus (100) for remotely interconnecting respective free ends (200a, 200b) of first and second portions of a mooring tether, said apparatus being **characterized in that** it comprises pull-in means (180) operable to pull-in to said apparatus the free end of one of said portions of mooring tether, subsequent to deployment of the apparatus; means for releasably mounting a connector (140), said means being designed to mount a connector (140) that is operable to interconnect the respective free ends (200a, 200b) of said first and second portions of the mooring tether, once said pull-in means (180) has pulled in to said apparatus (100) the free end of a first (200a) of said portions of mooring tether, said means being operable to release the connector (140) subsequent to interconnection.
2. Apparatus as claimed in claim 1 wherein said tether connection apparatus (100) is operable to have said connector (140) mounted to said means for releasably mounting a connector, wherein said connector is attached to the free end of a second of said portions of mooring tether, prior to deployment of the apparatus.
3. Apparatus as claimed in claim 1 or 2 wherein said tether connection apparatus is operable to connect a first (200a) of said portions of mooring tether that is attached to an anchor on the seabed, and a second (200b) of said portions of mooring tether that is attached to an object to be moored.
4. Apparatus as claimed in any preceding claim wherein said means for releasably mounting a connector is designed specifically to enable mounting of standard connectors (140), already commonly used for connecting lines, or portions of lines, together.
5. Apparatus as claimed in claim 4 wherein such connectors (140) are any of the type commonly used to connect together, chain with chain, chain with wire or wire with wire, as appropriate.
6. Apparatus as claimed in any preceding claim wherein said means for releasably mounting a connector (140) is adapted to be able to mount two or more types of connectors.
7. Apparatus as claimed in any preceding claim wherein said apparatus further comprises a suitable connector, pre-installed on said means for releasably mounting a connector.

8. Apparatus as claimed in any preceding claim wherein said apparatus comprises alignment means (120) aligning one portion of the mooring tether with the other prior to their being interconnected.
9. Apparatus as claimed in claim 8 wherein said alignment means comprises a channel (260) having a relatively wide opening, tapering inwards, thus forming a funnel shape, said channel (260) being arranged to accommodate the free end of said portions of mooring tether to correctly locate and align said free end, for subsequent interconnection said channel.
10. Apparatus as claimed in claim 9 wherein said channel (260) comprises a restricted section for locating and orienting one of said free ends of portion of mooring tether.
11. Apparatus as claimed in claim 10 wherein said restricted section comprises one or more locating pins (280) designed to cooperate with and therefore properly locate and orientate a link of mooring chain.
12. Apparatus as claimed in any preceding claim wherein said pull-in means comprises a winch (180).
13. A method of mooring an object to the seabed using the tether connection apparatus as claimed in any preceding claim, said method comprising:
- installing a connector on said tether connection apparatus;
 - installing at least one anchor on the seabed, said anchor having a first portion of mooring tether attached thereto.
 - installing said tether connection apparatus to the free end of a second portion of mooring tether, the other end of which being attached to the object to be moored;
 - connecting the free end of a second portion of mooring tether to said connector;
 - deploying said free end of the second portion of mooring tether with said tether connection apparatus attached thereto;
 - using said pull-in means to pull in the free end of said first portion of mooring tether to said tether connection apparatus;
 - connecting the free end of said first portion of mooring tether to said connector, thus interconnecting the first and second portions of mooring tether; and
 - releasing the connector from said means for releasably mounting a connector.
14. Method as claimed in claim 13 wherein one or more of the steps including and subsequent to the deployment step is done by a Remotely Operated Vehicle

(ROV).

15. Method as claimed claims 13 or 14 wherein said method preferably comprises the final step of recovering said tether connection apparatus.
16. Method as claimed in claim 13, 14 or 15 wherein said method comprises the step of aligning one portion of the mooring tether with the other prior to their being interconnected.
17. Method as claimed in claim 16 wherein it is the free end of first portion of the mooring tether that is aligned relative to the free end of said second portion of the mooring tether and connector.
18. Method as claimed in claim 17 wherein said free end of first portion of the mooring tether is pulled into a channel comprised in said tether connection apparatus to correctly locate and align said free end, for subsequent interconnection.
19. Method as claimed in claim 18 wherein said channel, and therefore said portion of said mooring leg located therein, is moved relative to second portion of the mooring tether and said connecting means to aid alignment.
20. Method as claimed in any of claims 13 to 19 wherein said first portion of mooring tether is pre-routed on the seabed prior to it being pulled-in to said tether connection apparatus.

Patentansprüche

1. Halteverbindungs Vorrichtung (100) zum entfernten Koppeln jeweiliger freier Enden (200a, 200b) eines ersten und zweiten Abschnitts einer Festmacherhalteleine, wobei die Vorrichtung **dadurch gekennzeichnet ist, dass** sie Folgendes umfasst:

Einzugsmittel (180), die dahingehend betrieben werden können, nach dem Einsatz der Vorrichtung das freie Ende eines der Abschnitte der Festmacherhalteleine zu der Vorrichtung zu ziehen;

Mittel zum lösbaren Befestigen eines Verbindungsstücks (140), wobei die Mittel ausgelegt sind, ein Verbindungsstück (140) zu befestigen, das dahingehend betrieben werden kann, die jeweiligen freien Enden (200a, 200b) des ersten und zweiten Abschnitts der Festmacherhalteleine miteinander zu verbinden, nachdem das Einzugsmittel (180) das freie Ende eines ersten (200a) der Abschnitte der Festmacherhalteleine zu der Vorrichtung (100) gezogen hat, wobei das Mittel dahingehend betrieben werden kann, das

Verbindungsstück (140) nach der Kopplung freizugeben.

2. Vorrichtung nach Anspruch 1, wobei die Halteverbindungs-
vorrichtung (100) dahingehend betrieben werden kann, das Verbindungsstück (140) aufzu-
weisen, das an dem Mittel zum lösbaren Befestigen
eines Verbindungsstücks befestigt ist, wobei das
Verbindungsstück vor dem Einsatz der Vorrichtung
an dem freien Ende eines zweiten der Abschnitte
der Festmacherhalteleine angebracht wird. 5
3. Vorrichtung nach Anspruch 1 oder 2, wobei die Halte-
verbindungs-
vorrichtung betrieben werden kann, einen ersten (200a) der Abschnitte der Festmacher-
halteleine, der an einem Anker am Meeresboden an-
gebracht ist, und einen zweiten (200b) der Abschnit-
te der Festmacherhalteleine, der an einem festzu-
machenden Objekt angebracht ist, zu verbinden. 10
4. Vorrichtung nach einem vorhergehenden Anspruch, wobei das Mittel zum lösbaren Befestigen eines Ver-
bindungsstücks spezifisch dafür ausgelegt ist, das
Befestigen von Standardverbindungsstücken (140),
die bereits üblicherweise zum Koppeln von Leinen
oder Abschnitten von Leinen verwendet werden, zu
ermöglichen. 15
5. Vorrichtung nach Anspruch 4, wobei solche Verbin-
dungsstücke (140) beliebige des Typs sind, die üb-
licherweise verwendet werden, um Kette mit Kette,
Kette mit Draht oder Draht mit Draht zu verbinden,
wie angebracht. 20
6. Vorrichtung nach einem vorhergehenden Anspruch, wobei das Mittel zum lösbaren Befestigen eines Ver-
bindungsstücks (140) dafür ausgelegt ist, in der Lage
zu sein, zwei oder mehrere Typen von Verbindungs-
stücken zu befestigen. 25
7. Vorrichtung nach einem vorhergehenden Anspruch, wobei die Vorrichtung weiterhin ein geeignetes Ver-
bindungsstück umfaßt, an dem Mittel zum lösbaren
Befestigen eines Verbindungsstücks vorinstalliert. 30
8. Vorrichtung nach einem vorhergehenden Anspruch, wobei die Vorrichtung Ausrichtmittel (120) umfaßt
zum Ausrichten eines Abschnitts der Festmacher-
halteleine mit dem anderen, bevor sie gekoppelt wer-
den. 35
9. Vorrichtung nach Anspruch 8, wobei das Ausricht-
mittel einen Kanal (260) mit einer relativ breiten, sich
nach innen verjüngenden Öffnung umfaßt, wodurch
eine Trichtergestalt ausgebildet wird, wobei der Ka-
nal (260) ausgelegt ist zum Aufnehmen des freien
Endes der Abschnitte der Festmacherhalteleine, um
das freie Ende korrekt zu lokalisieren und auszurich-
ten. 40

ten, zur späteren Kopplung des Kanals.

10. Vorrichtung nach Anspruch 9, wobei der Kanal (260)
eine eingeschränkte Sektion umfaßt zum Lokalisie-
ren und Orientieren eines der freien Enden eines
Abschnitts der Festmacherhalteleine. 45
11. Vorrichtung nach Anspruch 10, wobei die einge-
schränkte Sektion einen oder mehrere lokalisieren-
de Stifte (280) umfaßt, die ausgelegt sind, mit einem
Glieder einer Festmacherkette zusammenzuarbeiten
und es deshalb ordnungsgemäß zu lokalisieren und
zu orientieren. 50
12. Vorrichtung nach einem vorhergehenden Anspruch,
wobei das Einzugsmittel eine Winde (180) umfaßt.
13. Verfahren zum Festmachen eines Objekts am Mee-
resbodens unter Verwendung der Halteverbind-
ungsvorrichtung nach einem vorhergehenden An-
spruch, wobei das Verfahren Folgendes umfaßt:

Installieren eines Verbindungsstücks an der
Halteverbindungs-
vorrichtung;
Installieren mindestens eines Ankers am Mee-
resboden, wobei der Anker einen daran ange-
brachten ersten Abschnitt einer Festmacherhal-
teleine aufweist;
Installieren der Halteverbindungs-
vorrichtung an
dem freien Ende eines zweiten Abschnitts der
Festmacherhalteleine, deren anderes Ende an
dem festzumachenden Objekt angebracht ist;
Verbinden des freien Endes eines zweiten Ab-
schnitts der Festmacherhalteleine an den Ver-
bindungsstücken;
Einsetzen des freien Endes des zweiten Ab-
schnitts der Festmacherhalteleine mit der daran
angebrachten Halteverbindungs-
vorrichtung;
Verwenden des Einzugsmittels zum Einziehen
des freien Endes des ersten Abschnitts der Fest-
macherhalteleine zu der Halteverbindungs-
vorrichtung;
Verbinden des freien Endes des ersten Ab-
schnitts der Festmacherhalteleine mit dem Ver-
bindungsstück, wodurch der erste und zweite
Abschnitt der Festmacherhalteleine gekoppelt
werden; und
Lösen des Verbindungsstücks von dem Mittel
zum lösbaren Befestigen eines Verbindungs-
stücks. 55
14. Verfahren nach Anspruch 13, wobei einer oder meh-
rere der Schritte einschließlich und nach dem Ein-
satzschritt durch ein ROV (Remotely Operated Ve-
hicle - ferngesteuertes Fahrzeug) erfolgt.
15. Verfahren nach Anspruch 13 oder 14, wobei das Ver-
fahren bevorzugt den finalen Schritt des Bergens der

Halteverbindungs Vorrichtung umfaßt.

16. Verfahren nach Anspruch 13, 14 oder 15, wobei das Verfahren den Schritt des Ausrichtens eines Abschnitts der Festmacherhalteleine auf den anderen umfaßt, bevor sie gekoppelt werden. 5
17. Verfahren nach Anspruch 16, wobei es das freie Ende des ersten Abschnitts der Festmacherhalteleine ist, der relativ zum freien Ende des zweiten Abschnitts der Festmacherhalteleine und dem Verbindungsstück ausgerichtet wird. 10
18. Verfahren nach Anspruch 17, wobei das freie Ende des ersten Abschnitts der Festmacherhalteleine in einen Kanal eingezogen wird, der in der Halteverbindungs Vorrichtung enthalten ist, um zur späteren Koppelung das freie Ende korrekt zu lokalisieren und auszurichten. 15
19. Verfahren nach Anspruch 18, wobei der Kanal, und deshalb der darin angeordnete Abschnitt des Festmacherschenkels, relativ zum zweiten Abschnitt der Festmacherhalteleine und des Verbindungsmittels bewegt wird, um die Ausrichtung zu unterstützen. 20
20. Verfahren nach einem der Ansprüche 13 bis 19, wobei der erste Abschnitt der Festmacherhalteleine auf dem Meeresboden vorverlegt wird, bevor er zu der Halteverbindungs Vorrichtung eingezogen wird. 25 30

Revendications

1. Appareil de jonction (100) de lignes destiné à relier entre elles à distance des extrémités libres (200a, 200b) respectivement d'une première et d'une deuxième portion d'une ligne d'ancrage, ledit appareil étant **caractérisé en ce qu'il** comprend : 35
 - un moyen de traction (180) pouvant être actionné pour tirer dans ledit appareil l'extrémité libre de l'une desdites portions de la ligne d'ancrage, suite au déploiement de l'appareil ;
 - un moyen destiné à monter en vue de sa libération un connecteur (140), ledit moyen étant conçu pour monter un connecteur (140) pouvant être actionné pour relier entre elles les extrémités libres (200a, 200b) respectivement desdites première et deuxième portions de la ligne d'ancrage, une fois que ledit moyen de traction (180) a tiré dans ledit appareil (100) l'extrémité libre d'une première (200a) desdites portions de la ligne d'ancrage, ledit moyen pouvant être actionné pour libérer le connecteur (140) une fois la jonction réalisée. 40 45 50 55
2. Appareil selon la revendication 1, dans lequel ledit

appareil de jonction (100) de lignes peut être actionné pour que l'on puisse monter ledit connecteur (140) sur ledit moyen destiné à monter un connecteur en vue de sa libération, dans lequel ledit connecteur est fixé à l'extrémité libre d'une deuxième desdites portions de la ligne d'ancrage, avant le déploiement de l'appareil.

3. Appareil selon les revendications 1 ou 2, dans lequel ledit appareil de jonction de lignes peut être actionné pour relier une première (200a) desdites portions de la ligne d'ancrage qui est attachée à une ancre sur le fond marin et une deuxième (200b) desdites portions de la ligne d'ancrage qui est attachée à un objet à amarrer.
4. Appareil selon l'une quelconque des revendications précédentes, dans lequel ledit moyen destiné à monter un connecteur en vue de sa libération est spécifiquement conçu pour permettre de monter des connecteurs standard (140), déjà communément employés pour joindre ensemble des lignes ou des portions de lignes.
5. Appareil selon la revendication 4, dans lequel lesdits connecteurs (140) sont de tout type communément employé pour joindre ensemble une chaîne et une chaîne, une chaîne et un câble ou un câble et un câble, selon les besoins.
6. Appareil selon l'une quelconque des revendications précédentes, dans lequel ledit moyen destiné à monter en vue de sa libération un connecteur (140) est adapté pour pouvoir monter au minimum deux types de connecteurs.
7. Appareil selon l'une quelconque des revendications précédentes, dans lequel ledit appareil comprend en outre un connecteur approprié, préinstallé sur ledit moyen destiné à monter un connecteur en vue de sa libération.
8. Appareil selon l'une quelconque des revendications précédentes, dans lequel ledit appareil comprend un moyen d'alignement (120) destiné à aligner une portion de la ligne d'ancrage avec l'autre avant de les joindre entre elles.
9. Appareil selon la revendication 8, dans lequel ledit moyen d'alignement comprend une gorge (260) dotée d'une ouverture relativement large, se rétrécissant vers l'intérieur, définissant ainsi une forme d'entonnoir, ladite gorge (260) étant placée pour recevoir l'extrémité libre desdites portions de ligne d'ancrage afin de positionner et aligner correctement ladite extrémité libre en vue d'une future jonction dans ladite gorge.

10. Appareil selon la revendication 9, dans lequel ladite gorge (260) comprend une section rétrécie pour positionner et orienter l'une desdites extrémités libres d'une portion de la ligne d'ancrage.
11. Appareil selon la revendication 10, dans lequel ladite section rétrécie comprend un ou plusieurs ergots de guidage (280), conçus pour coopérer avec un maillon de la chaîne d'ancrage afin de le positionner et de l'orienter correctement.
12. Appareil selon l'une quelconque des revendications précédentes, dans lequel ledit moyen de traction comprend un treuil (180).
13. Procédé d'ancrage d'un objet sur le fond marin à l'aide de l'appareil de jonction de lignes selon l'une quelconque des revendications précédentes, ledit procédé comprenant les étapes suivantes :
- installer un connecteur sur ledit appareil de jonction de lignes ;
 - installer au moins une ancre sur le fond marin, ladite ancre étant attachée à une première portion d'une ligne d'ancrage ;
 - installer ledit appareil de jonction de lignes à l'extrémité libre d'une deuxième portion de la ligne d'ancrage, l'autre extrémité de cette dernière étant attachée à l'objet à ancrer ;
 - joindre l'extrémité libre d'une deuxième portion de la ligne d'ancrage et ledit connecteur ;
 - déployer ladite extrémité libre de la deuxième portion de la ligne d'ancrage, ledit appareil de jonction de lignes étant attaché à cette dernière ;
 - utiliser ledit moyen de traction pour tirer l'extrémité libre de ladite première portion de la ligne d'ancrage dans ledit appareil de jonction de lignes ;
 - joindre l'extrémité libre de ladite première portion de la ligne d'ancrage et ledit connecteur, reliant ainsi entre elles les première et deuxième portions de la ligne d'ancrage ; et
 - libérer le connecteur dudit moyen destiné à monter un connecteur en vue de sa libération.
14. Procédé selon la revendication 13, dans lequel une ou plusieurs étapes, et notamment l'étape de déploiement et les suivantes, sont réalisées par un engin télécommandé.
15. Procédé selon les revendications 13 ou 14, dans lequel ledit procédé comprend de préférence l'étape finale de récupérer ledit appareil de jonction de lignes.
16. Procédé selon les revendications 13, 14 ou 15, dans lequel ledit procédé comprend l'étape d'aligner une portion de la ligne d'ancrage sur l'autre avant de les

joindre ensemble.

17. Procédé selon la revendication 16, dans lequel c'est l'extrémité libre de la première portion de la ligne d'ancrage qui est alignée par rapport à l'extrémité libre de ladite deuxième portion de la ligne d'ancrage et au connecteur.
18. Procédé selon la revendication 17, dans lequel ladite extrémité libre de la première portion de la ligne d'ancrage est tirée dans une gorge prévue dans ledit appareil de jonction de lignes pour positionner et aligner correctement ladite extrémité libre en vue d'une future jonction.
19. Procédé selon la revendication 18, dans lequel ladite gorge, et donc ladite portion de ladite ligne d'ancrage située à l'intérieur, est déplacée par rapport à la deuxième portion de la ligne d'ancrage et ledit moyen de jonction pour faciliter l'alignement.
20. Procédé selon l'une quelconque des revendications 13 à 19, dans lequel ladite première portion de la ligne d'ancrage est prépositionnée sur le fond marin avant d'être tirée dans ledit appareil de jonction de lignes.

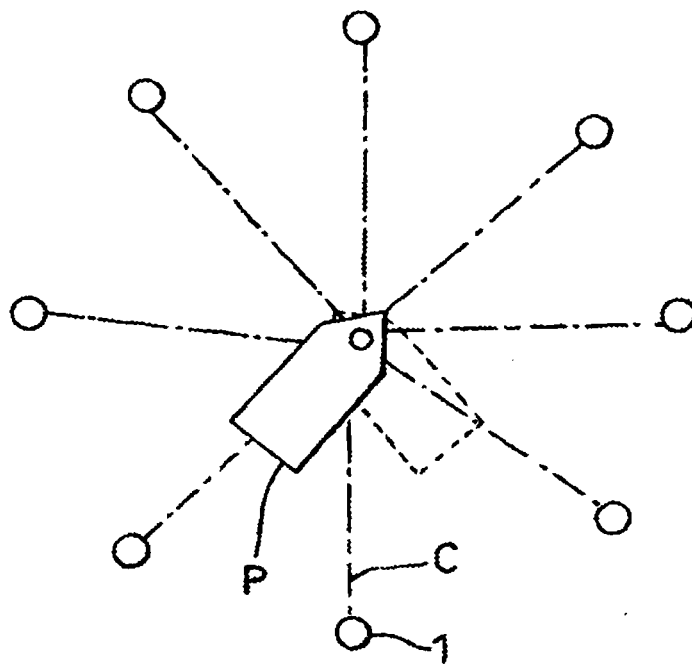


Fig. 1(a)

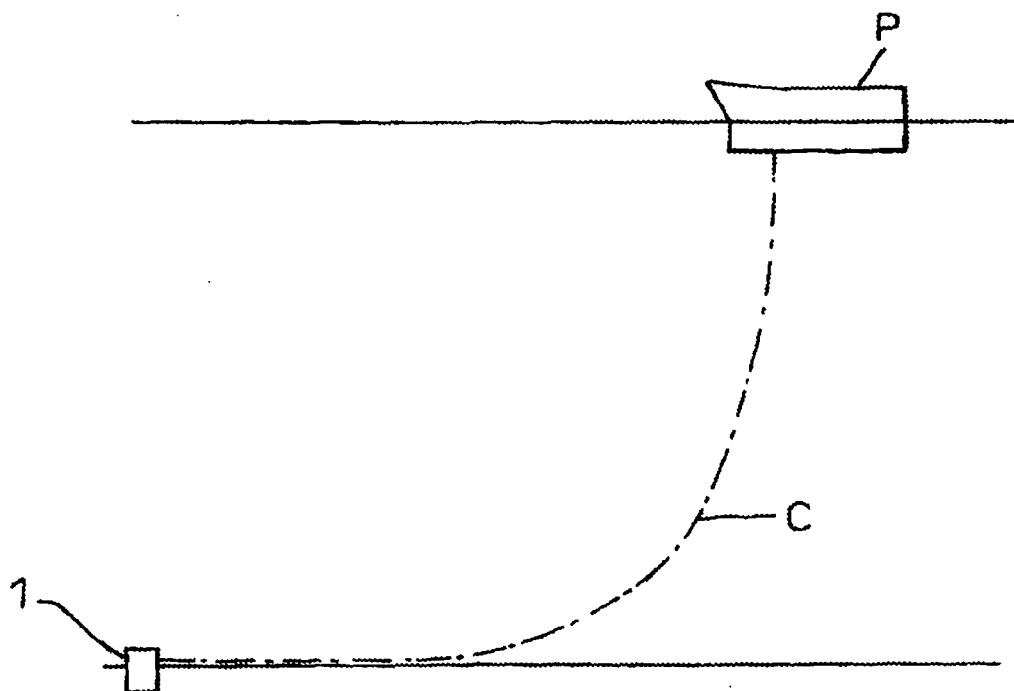


Fig. 1(b)

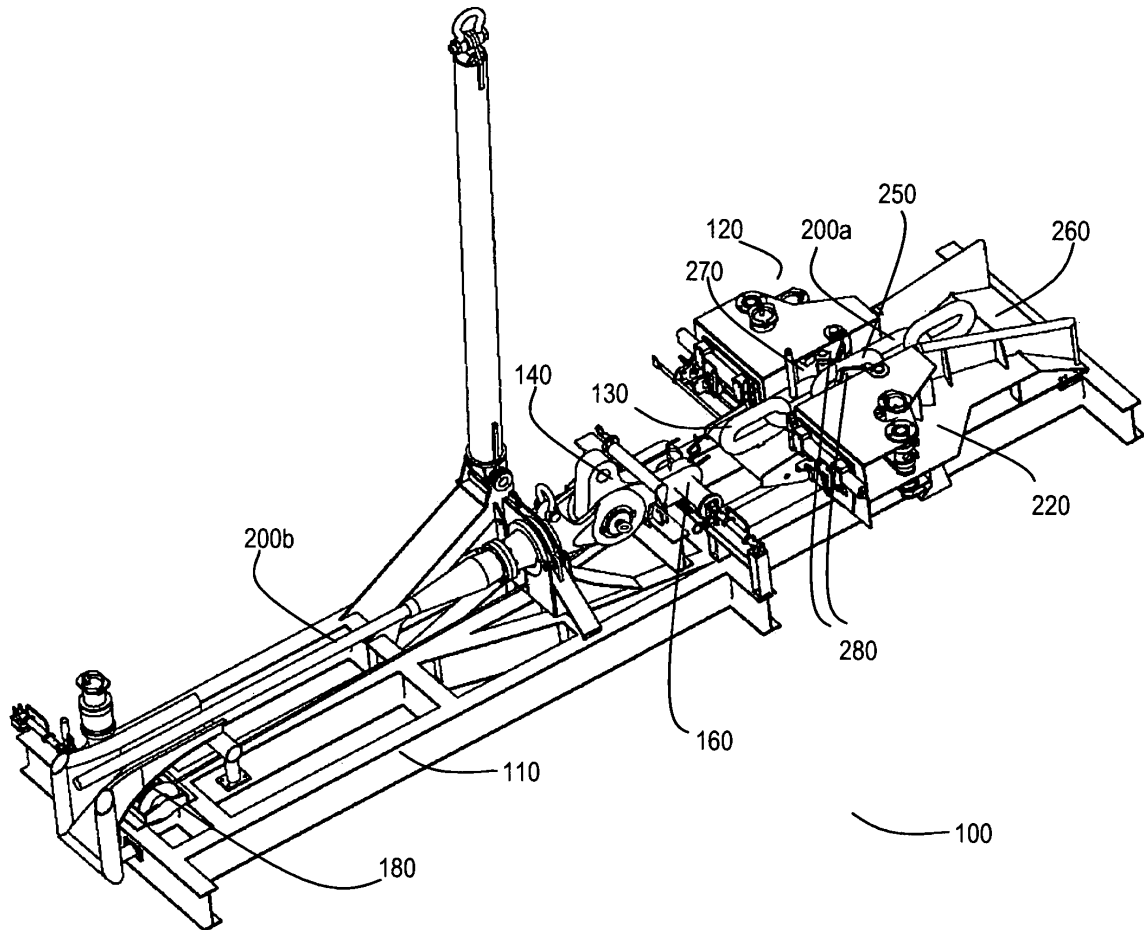


Fig. 2

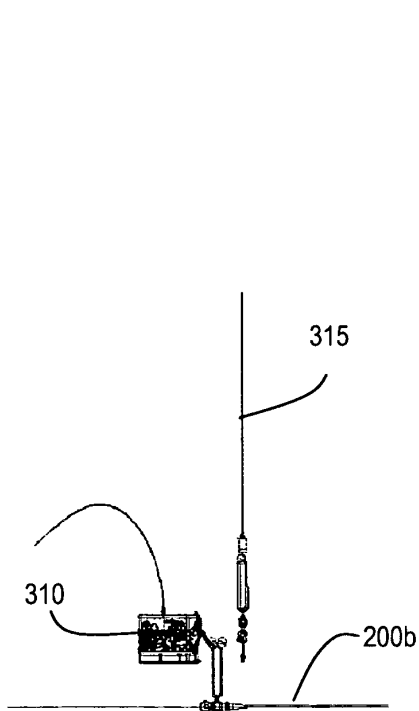


Fig. 3a

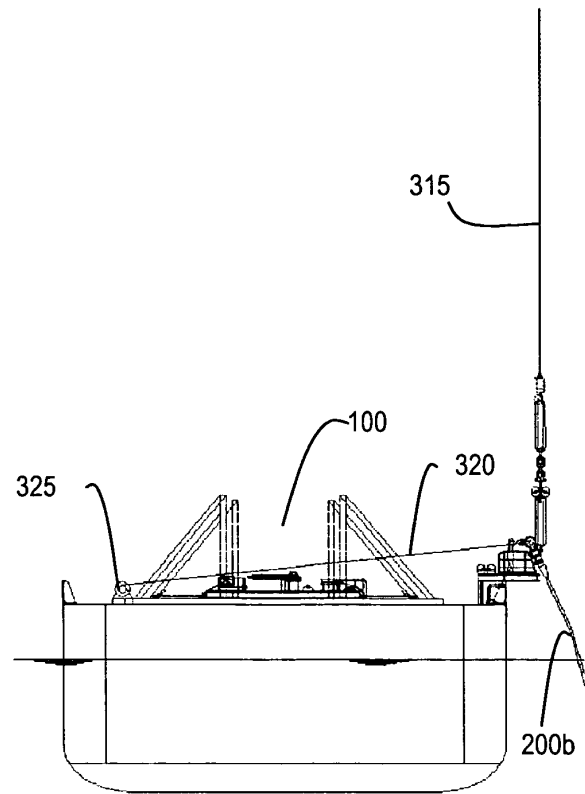


Fig. 3b

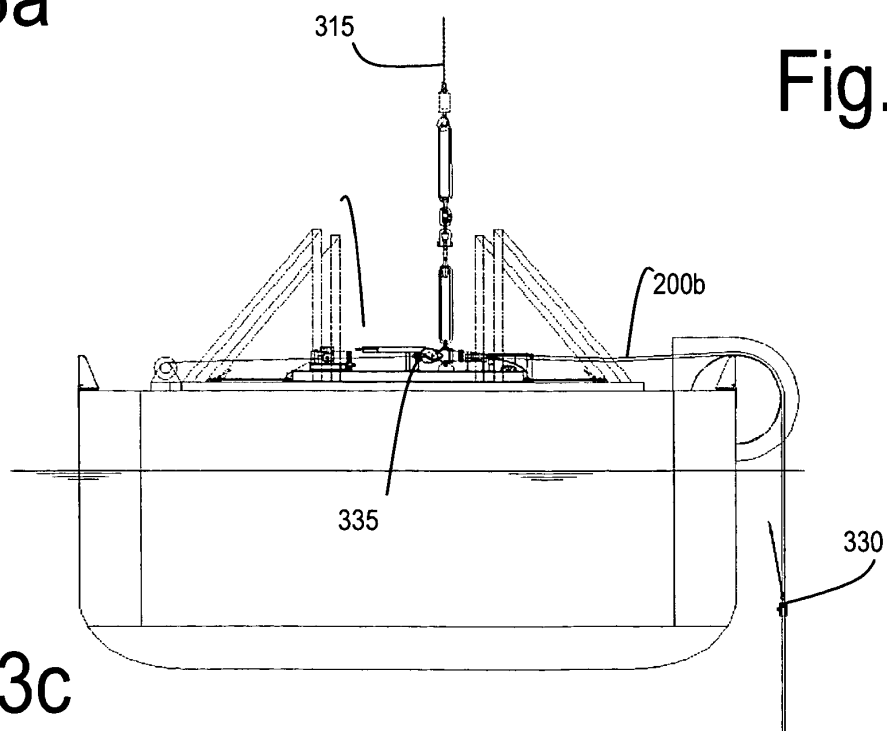


Fig. 3c

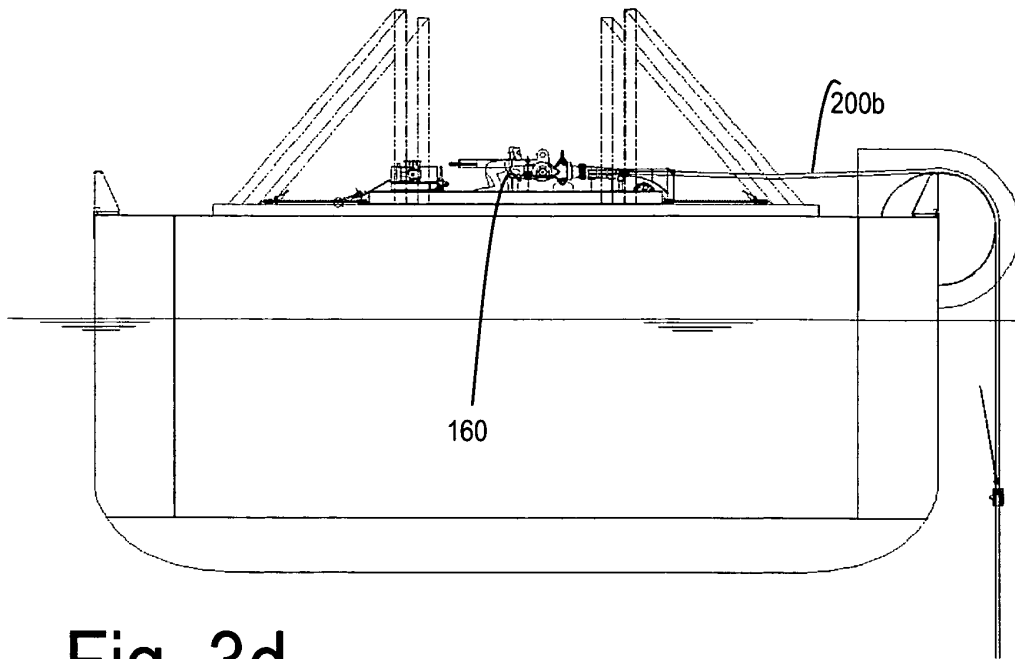


Fig. 3d

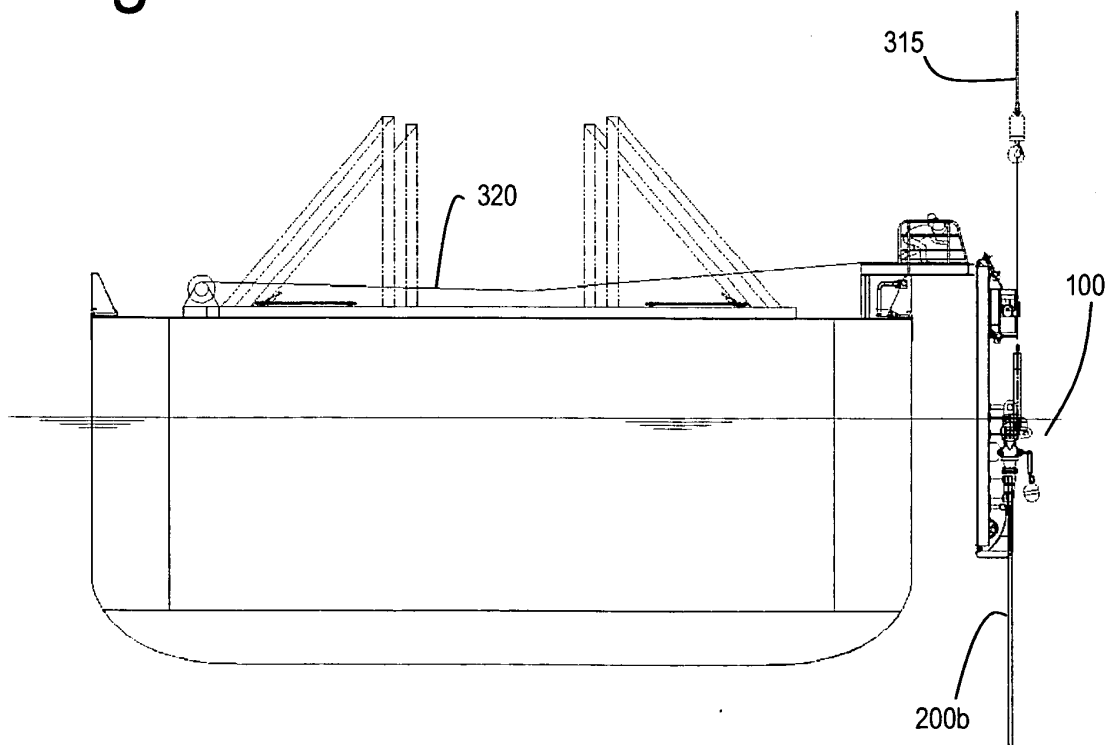


Fig. 3e

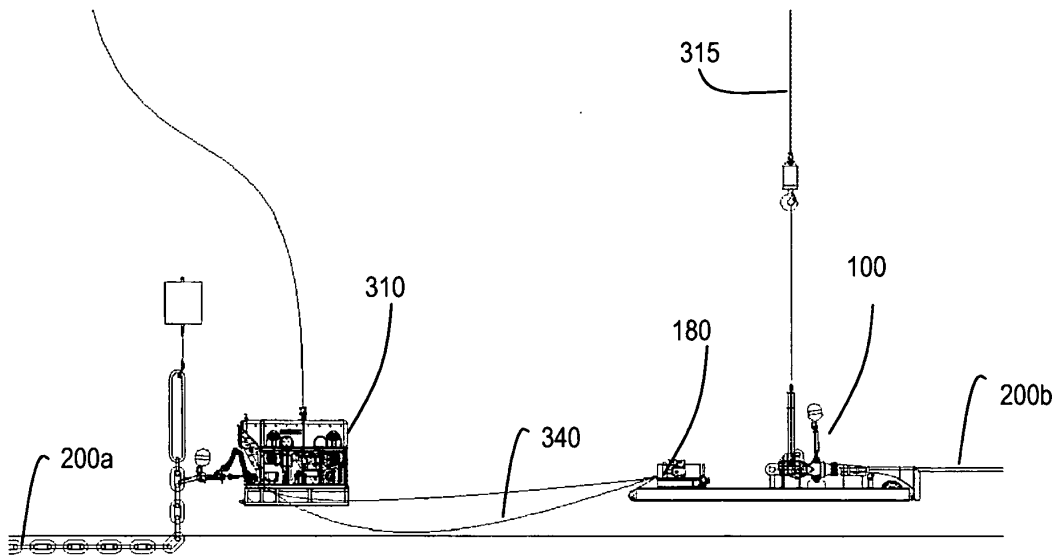


Fig. 3f

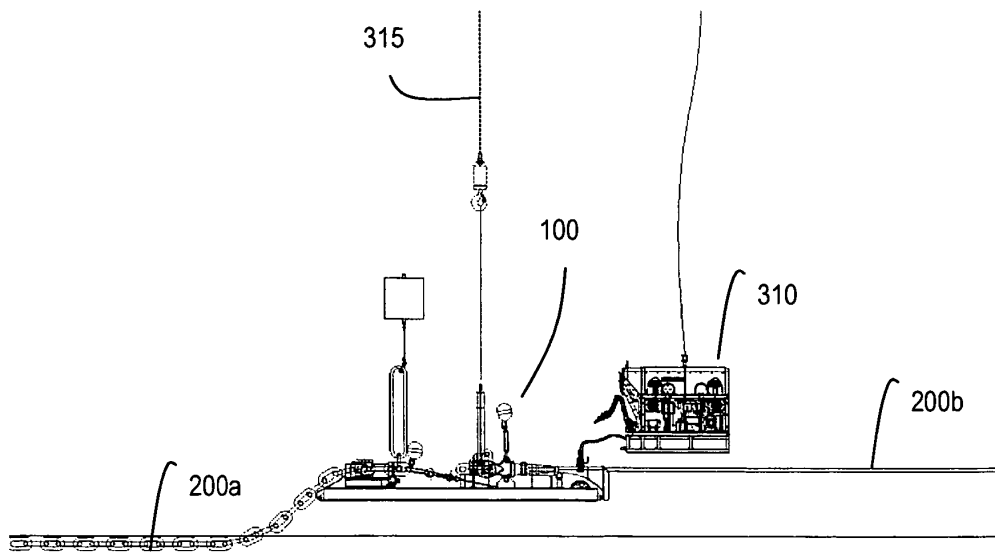


Fig. 3g

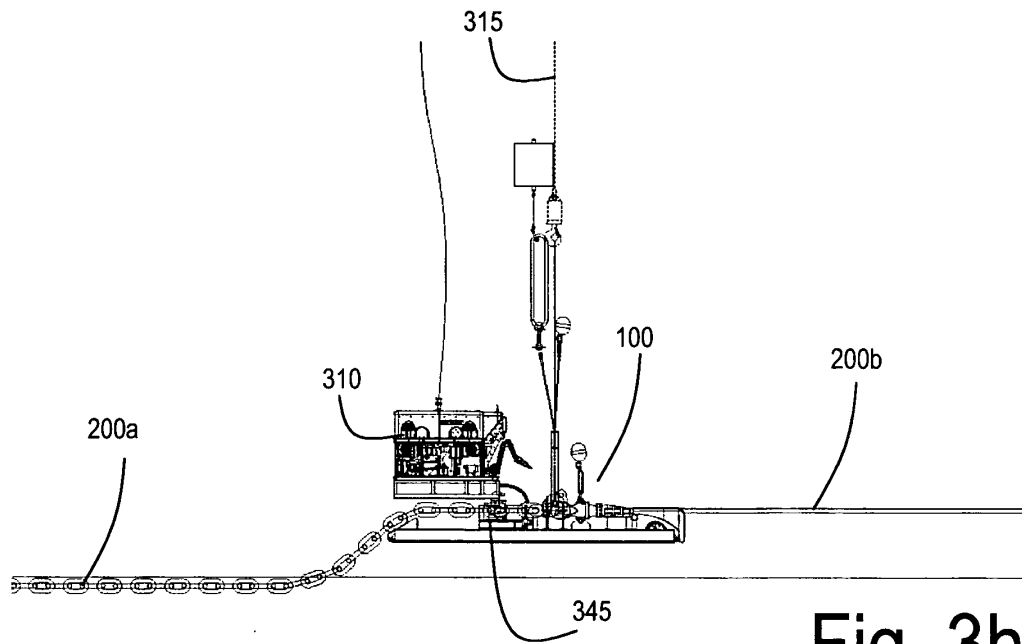


Fig. 3h

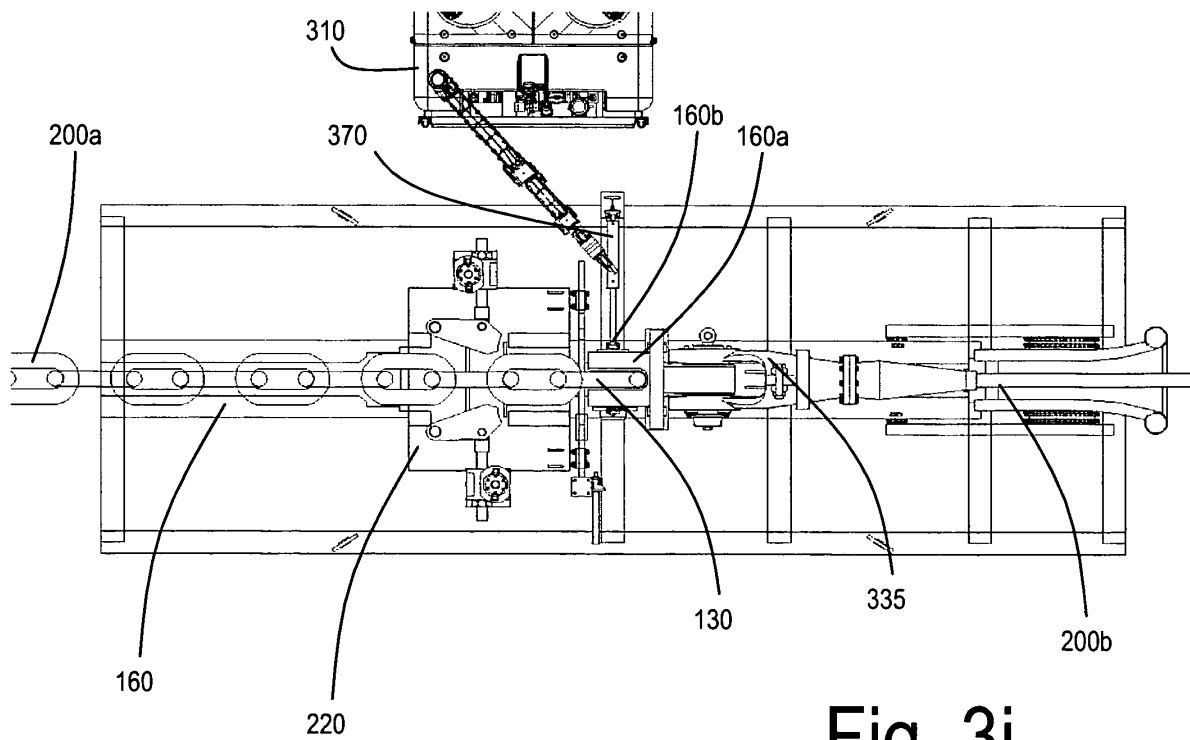


Fig. 3i

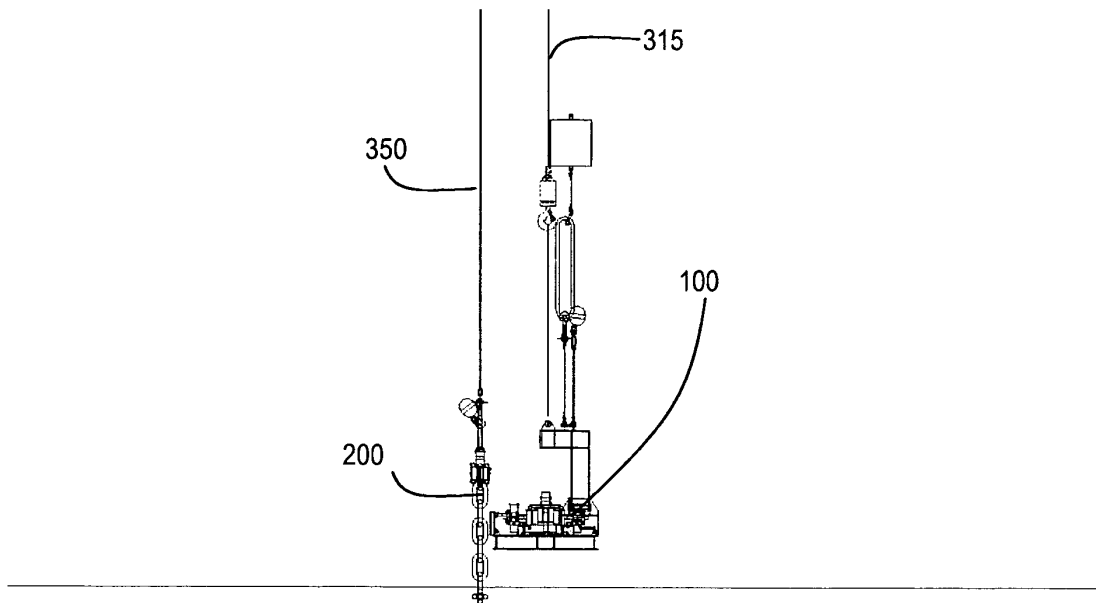


Fig. 3j

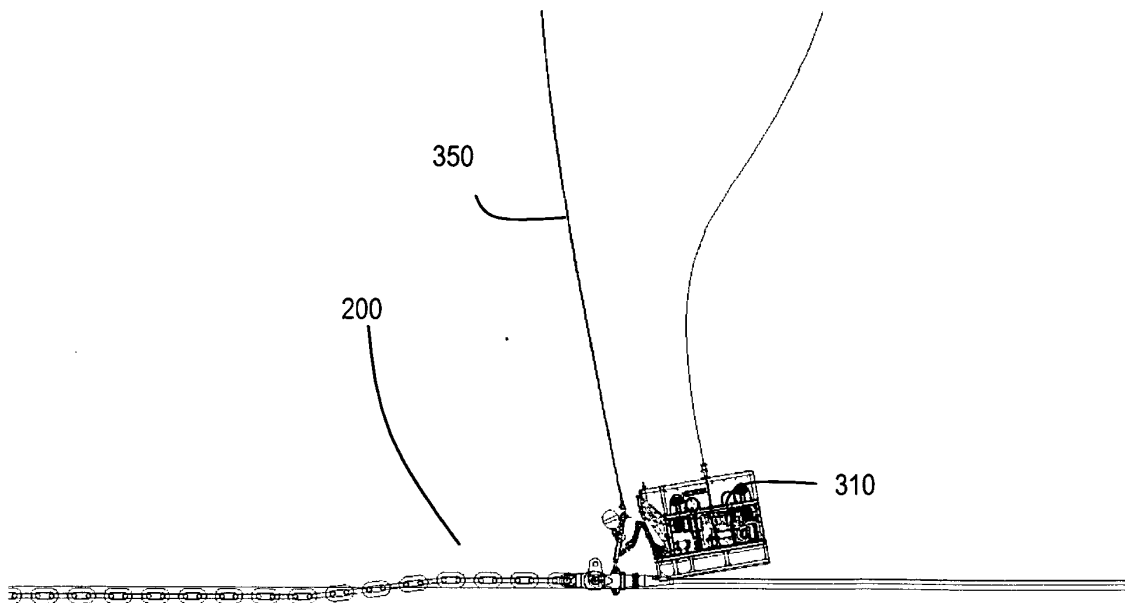


Fig. 3k

REFERENCES CITED IN THE DESCRIPTION

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